angiographic parameters cannot and should not be used as a surrogate for coronary flow.

Finally, recent data by Sant'Anna et al. (12) challenge our assumptions regarding whether angiographic 3-vessel disease is truly physiological 3-vessel disease. Of the 250 patients undergoing angiography, when the 27% of patients with angiographic 3-vessel disease had FFR measured in all 3 of these vessels, only 9% were found to have physiologically significant 3-vessel coronary disease. Had bypass grafting been performed, a considerable incidence of graft failure would be expected at follow-up. Fortunately, in this setting graft failure is often clinically silent with the consequences of graft closure across nonsignificant lesions reverting to the native vessel, which remains patent and functional (unless the lesion progresses).

Whereas the debate about the use of the GEA graft continues, a critical question before the surgery for those vessels with intermediately severe stenoses should be answered by direct physiologic measurements: is a graft on this particular vessel going to be of any use if the physiology is nearly normal (13)?

***Morton J. Kern, MD, FSCAI, FAHA, FACC**

*Professor of Medicine
Associate Chief Cardiology
Director Clinical Affairs
University of California, Irvine
Building 53, Route 81, Room 100
101 The City Drive
Orange, California 92868-4080
E-mail: mkern@uci.edu

doi:10.1016/j.jacc.2008.02.089

Please note: Dr. Kern is a speaker for Radi Medical and Volcano Therapeutics, 2 companies that manufacture the pressure guidewire used in the physiologic assessment of coronary artery disease.

REFERENCES

1. Glineur D, D'hoore W, El Khoury G, et al. Angiographic predictors of 6-month patency of bypass grafts implanted to the right coronary artery. J Am Coll Cardiol 2008;51:120–5.
2. Sabik JF, Blackstone EH. Coronary artery bypass graft patency and competitive flow. J Am Coll Cardiol 2008:51:126–8.
3. Hashimoto H, Isshiki T, Ikari Y, et al. Effects of competitive blood flow on arterial graft patency and diameter. Medium-term postoperative follow-up. J Thoracic Cardiovasc Surg 1996;111:399–407.
4. Tedoriya T, Kawasuji M, Sakakibara N, Ueyama K, Watanabe Y. Pressure characteristics in arterial grafts for coronary bypass surgery. Cardiovasc Surg 1995;3:381–5.
5. Sabik JF III, Lytle BW, Blackstone EH, Khan M, Houghtaling PL, Cosgrove DM. Does competitive flow reduce internal thoracic artery graft patency? Ann Thorac Surg 2003;76:1460–6.
6. Kern MJ, Lerman A, Bech JW, et al. Physiological assessment of coronary artery disease in the cardiac catheterization laboratory: a scientific statement from the American Heart Association Committee on Diagnostic and Interventional Cardiac Catheterization, Council on Clinical Cardiology. Circulation 2006;114;1321–41.
7. Topol EJ, Nissen SE. Our preoccupation with coronary luminology. The dissociation between clinical and angiographic findings in ischemic heart disease. Circulation 1995;92:2333–42.
8. Pijls NHJ, Van Gelder B, Van der Voort P, et al. Fractional flow reserve: a useful index to evaluate the influence of an epicardial coronary stenosis on myocardial blood flow. Circulation 1995;92:318–9.
9. Pijls NHJ, de Bruyne B, Peels K, et al. Measurement of fractional flow reserve to assess the functional severity of coronary-artery stenoses. N Engl J Med 1996;334:1703–8.
10. Botman CJ, Schonberger J, Koolen S, et al. Does stenosis severity of native vessels influence bypass graft patency? A prospective fractional flow reserve-guided study. Ann Thorac Surg 2007;83:2093–7.
11. Botman KJ, Pijls N, Bech JW, et al. Percutaneous coronary intervention or bypass surgery in multivessel disease? A tailored approach based on coronary pressure measurement. Catheter Cardiovasc Interv 2004; 63:184–91.
12. Sant'Anna FM, Silva EER, Batista LA, Venture FM, Barrozo CAM, Pijls NHJ. Influence of routine assessment of fractional flow reserve on decision making during coronary interventions. Am J Cardiol 2007;99:504–8.
13. Pijls NHJ, Van Schaardenburgh P, Manoharan G, et al. Percutaneous coronary intervention of functionally non-significant stenoses: 5 year follow-up of the Defer Study. J Am Coll Cardiol 2007;49:2105–11.

Reply

Dr. Kern wisely raised several points that were not discussed in our article (1). We are convinced of the interest of fractional flow reserve (FFR) as a tool to asses the physiological relevance of coronary stenoses, and we recently used this tool to compare the resistance to blood flow of several coronary graft configurations (2,3). Unfortunately, if all patients referred to bypass surgery underwent a pre-operative angiographic evaluation and if most of those angiographic documents could be analyzed quantitatively, very few patients would be referred to surgery with a full mapping of FFR on the different coronary segments.

In daily clinical practice, the use of FFR remains generally restricted to the evaluation of stenoses of intermediate severity and mainly in patients with <3-vessel disease who are planned to be treated by interventional cardiology. For patients referred to surgery with a 2- or 3-vessel disease, the decision to measure FFR for an intermediate stenosis associated with angiographically severe narrowing on other coronary segments is much less frequent, because the surgical indication is already present, on the basis of the critical lesions. In these cases, most cardiac surgeons choose to graft the intermediate lesion as well, even if this bypass is at risk of competitive flow. This attitude, although somewhat empirical, is based on the low risk expected from the possible occlusion of such nonfunctional grafts, on the hope that these grafts will remain patent long enough to provide some help in the case of progression of the intermediate lesion, and on the fear of a redo intervention, if lesion severity is underestimated. It still remains uncertain whether this is preferable to a more conservative attitude consisting of graft implantation only on severely narrowed coronary segments.

Several observations have illustrated the capacity of the internal thoracic artery (4) or right gastroepiploic artery (RGEA) (5) to recover function in the long term after having been found not functional (string sign) at early follow-up. This capacity seems related to endothelial protection mechanisms that are probably less prominent or totally absent in saphenous vein graft. Considering the natural progression of the disease on native vessels, this property could act in favor of RGEA in the longer term. The ongoing angiographic re-evaluation of the grafts at 3 years postoperatively could thus provide information susceptible to clarifying the meaning of these early findings, particularly in RGEA grafts with a balanced flow.

***David Glineur, MD**
William D'hoore, MD, PhD
Gebrine El Khoury, MD
Sixte Sondji, MD
Jean-Christophe Funken, MD

Jean Rubay, MD, PhD
Alain Poncelet, MD
Parla Astarci, MD
Robert Verhelst, MD
Philippe Noirhomme, MD
Claude Hanet, MD, PhD

*Service de Chirurgie cardiovasculaire et thoracique
Cliniques Universitaires Saint-Luc–U.C.L. 90
Avenue Hippocrate 10/6107
1200 Bruxelles
Belgium
E-mail: david.glineur@clin.ucl.ac.be

doi:10.1016/j.jacc.2008.05.045

REFERENCES

1. Glineur D, D'hoore W, El Khoury G, et al. Angiographic predictors of 6-month patency of bypass grafts implanted to the right coronary artery. J Am Coll Cardiol 2008;51:120–5.
2. Glineur D, Poncelet A, El Khoury G, et al. Fractional flow reserve of pedicled internal thoracic artery and saphenous vein grafts 6 months after bypass surgery. Eur J Cardiothorac Surg 2007;31:376–81.
3. Glineur D, Noirhomme P, Reisch J, El Khoury G, Astarci P, Hanet C. Resistance to flow of arterial Y-grafts 6 months after coronary artery bypass surgery. Circulation 2005;30:112 Suppl:I281–5.
4. Feld H, Navarro V, Kleeman H, Shani J. Early postoperative occlusion of a left internal mammary artery bypass graft with subsequent restoration of patency. Cathet Cardiovasc Diagn 1992;27:280–3.
5. Eda T, Matuura A, Miyahara K, et al. Spontaneous restoration of patency in the free gastroepiploic artery graft: the living transplanted vascular system for coronary revascularization. Ann Thorac Surg 2007; 83:2219–20.